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ABSTRACT

To determine the effect of format on the communication of information and the range of qualitative reaction, data was presented by bar graphs, data tables and natural language text to 24 staff members of the Southwest Regional Laboratory. No difference in acquisition of information among the staff members was shown. Subjects preferred data tables, and costs and complexities of preparing these tables were found not to be significant in small volume. Procedures of the study are detailed, and attachments provided showing the format used. (SK)

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TITLE: EXPLORATORY EXAMINATION OF ALTERNATIVE FORMATS FOR COMMUNICATING INSTRUCTIONAL PROFICIENCY STATUS INFORMATION

AUTHOR: Judith Hooper and Burt Roffman

ABSTRACT

The paper presents preliminary empirical and analytically derived information pertinent to three questions: To what extent does the format of a report affect the degree to which it conveys intended information? What range of qualitative reactions to a particular format might be expected from the intended audiences of a report? What are the computer programming costs and complexities associated with a given report format?

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EXPLORATORY EXAMINATION OF ALTERNATIVE FORMATS FOR COMMUNICATING INSTRUCTIONAL PROFICIENCY STATUS INFORMATION

Instructional proficiency status information may be communicated in several alternative formats. For example, bar graphs, data tables, and natural language text provide alternative means of communicating such information. While cost, time, and scale of operation constrain the feasible bounds of format diversification, it should be possible to provide a reasonable number of options consistent with user preference. This paper reports the results of an exploratory study addressing the following questions:

(a) To what extent does the format of a report affect the degree to which it conveys intended information?

(b) What range of qualitative reactions to a particular format might be expected from the intended audiences of a report?

(c) What are the computer programming costs and complexities associated with a given report format?

Procedures

Data on the first question was obtained by administering a test to measure the acquisition of equivalent information from a representative report presented in each of three alternative formats. The tests were administered individually to 24 staff members of the Laboratory. The 24 subjects were randomly divided into six groups of four and presented with the three tests in different sequences, thus effecting a Latin Square design and reducing the impact of ordering on performance. Standardized instructions were read to each subject at the beginning of

the testing session, and the length of time necessary to complete each of the three tests was recorded. Sample tests and format alternatives are shown in Attachments 1 and 2.

The second question was probed in conjunction with the testing by having subjects complete an open-ended evaluative questionnaire shown in Attachment 3.

To obtain estimates pertinent to the third question copies of the format alternatives were referred to the Computer Center with a request for comments regarding cost-complexity.

Results

Tables 1 and 2 present performance results of the subjects on the tests measuring acquisition of equivalent information from alternate formats. The data reveal that the mean performance score on all tests was approximately 18 out of a possible score of 20. The speed with which subjects acquired information from the test formats appears to vary much more than the accuracy of data interpretation.

Table 3 shows the format preference of subjects as indicated by their responses to the open-ended questionnaire. Twenty-one (88%) of the subjects selected data tables over the graph and text formats. Only one other person indicated a different preference by choosing the graph. Data on the frequency of positive and negative comments about each format are found in Attachment 4.

Estimates made by computer staff on relative computer programming difficulties associated with the three formats are presented in Attachment 5. Table 1 of the attachment lists by headings (HDGS) the data and total

TABLE 1

ACCURACY OF INTERPRETATION OF ALTERNATIVE FORMATS

TABLE	N	SCORES $\bar{X}$	S.D.	MEAN DIFFERENCES	
Graph (A)	24	18.16	2.13	AB	.71
Data (B) Tables	24	18.87	.99	BC	.00
Text (C)	24	18.87	1.22	AC	.71

TABLE 2

TIME REQUIRED TO COMPLETE ALTERNATIVE FORMATS

TABLE	N	TIME $\bar{X}$	S.D.	MEAN DIFFERENCES	
Graph (A)	24	6:38	1:36	AB	1:89*
Data (B) Tables	24	4:49	1:16	BC	:86*
Text (C)	24	5:35	1:57	AC	:21

N = 24, df = 23

* indicates $P < .05$

TABLE 3

FORMAT PREFERENCES AS INDICATED ON QUESTIONNAIRE

FORMAT	N	%
Graph (A)	1	(4)
Data (B) Tables	21	(88)
Text (C)	0	(0)
No response	2	(8)

number of print lines necessary for 10 units of reports. Table 2 shows the length of data print lines for each unit of each report format. In each case Format B (data tables) requires the least amount of computer processing.

Summary and Discussion

The purpose of this inquiry was to probe three considerations in making a selection among IMS Function 1 alternative formats.

To what extent does the format of a report affect the degree to which it conveys intended information?

The results indicate that the information conveyed was easily acquired by the subjects. In fact, it is likely that the high performance of the subjects would have been even higher had the poorer test items been improved or deleted. Also, the report format had virtually no effect on accurate acquisition of information. However, graphs and text required significantly more time for subjects to gather this information.

The subjects of this study are not presently teaching. However, many of them have taught before and can relate to the teacher's concerns about reports and their formats. The educational range of the subjects varied from high school through the Ph.D. level, but performance did not vary. This suggests that the performance of teachers (most of whom have college degrees and graduate credits) may not differ significantly from that of the subjects tested.

What range of qualitative reactions to a particular format might be expected from the intended audiences of a report?

The questionnaire results indicate that the range of qualitative reactions to the three formats is very narrow. The data tables were almost unanimously preferred, and very few negative reactions were recorded. In addition, very few positive reactions to the graph and text formats were recorded, and the subjects concurred in their negative reactions. For example, 13 of the 22 subjects reacting to the graph format found it difficult to identify the exact percentage of students reaching criterion. Sixteen of them described the two page format as clumsy and awkward.

What are the computer programming costs and complexities associated with a given report format?

With respect to CPU time and possible print charges, there are probably no significant differences between the three formats when distributed in small volume. With a large volume of reports, the data table format would be less expensive to process. With regard to the time necessary to transmit data to the schools, data tables would take significantly less time to process in both small and large volume.

ATTACHMENT 1

REPORT #4

QUESTIONS ON CONTENT

1. Which instructional program is this report for? _____

2. Which class is this report for? _____

3. On which unit was no test given? _____

4. Did the class take a test on Unit 2? _____

5. What is the name of the skill associated with Outcome II? _____

6. How many pages are in this report? _____

7. What percentage of the students in this class reached criterion on Outcome I for Unit 1? _____

8. What percentage of the students in this class reached criterion on Outcome IV for Unit 6? _____

9. What percentage of the students in this class reached criterion on Outcome II for Unit 5? _____

10. On which units did less than 80% of the class reach criterion for Outcome III? _____

11. How many students did not reach criterion on Outcome I of Unit 2? _____

12. What percentage of the students did not reach criterion on Outcome III of Unit 7? _____

13. What percentage of the students did not reach criterion on Outcome IV of Unit 5? _____

14. On Word Attack for Unit 3, ____ percentage of the students reached criterion. _____

15. For Unit 3, on which Outcome did the class have the highest performance ? _____

    On which Outcome did the class have the lowest performance? _____

16. For Unit 6, on which Outcome did the class perform best? _____

    On which Outcome did the class perform least well? _____

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17. On Outcome IV, did the class show any improvement in performance between Unit 5 and Unit 6? _____

18. Did the class do better on the Word Attack Skill of Unit 5 or Unit 6? _____

5/14/71

ATTACHMENT 2

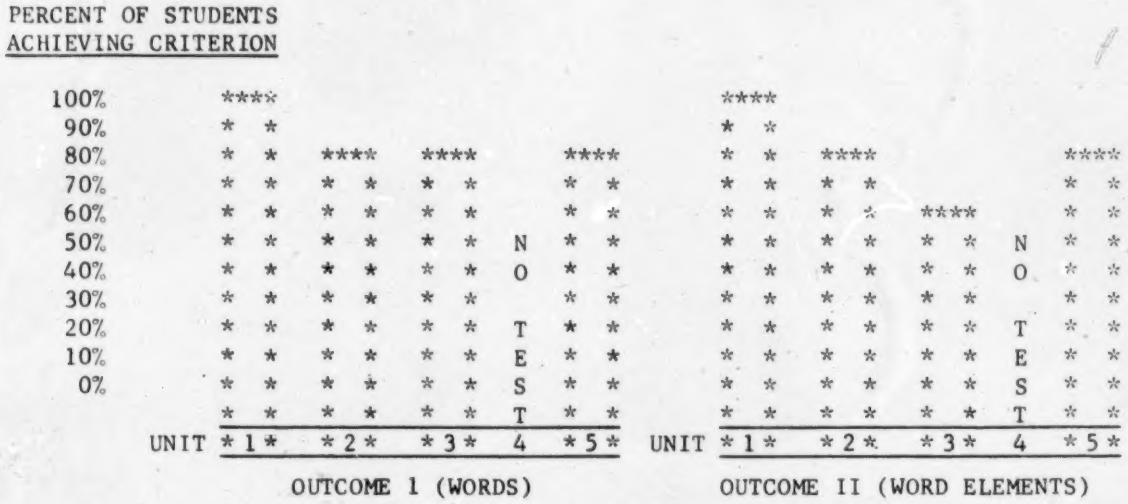
Display 4(A). Bar Graph showing the percentage of pupils within a class reaching criterion (80% correct on an outcome) on cummulative Criterion Exercises. (Reported in sets of five.)

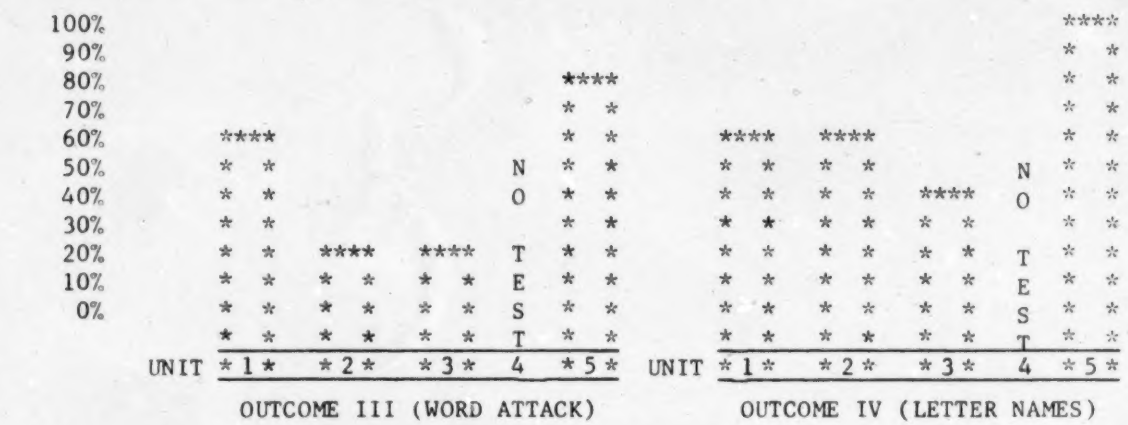
REPORT #4(A)

PROGRAM: SYCSP
UNITS: 1-5

DISTRICT: L.A. (A)
SCHOOL: FIRST ST.
TEACHER: HANKS

MAR. 31, 1971
CLASS: 1
PAGE 1





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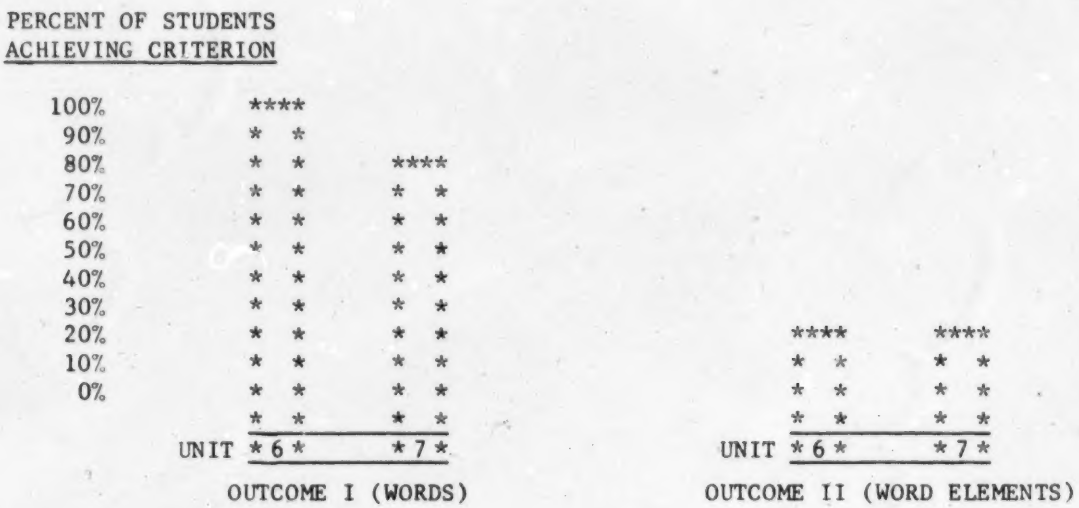
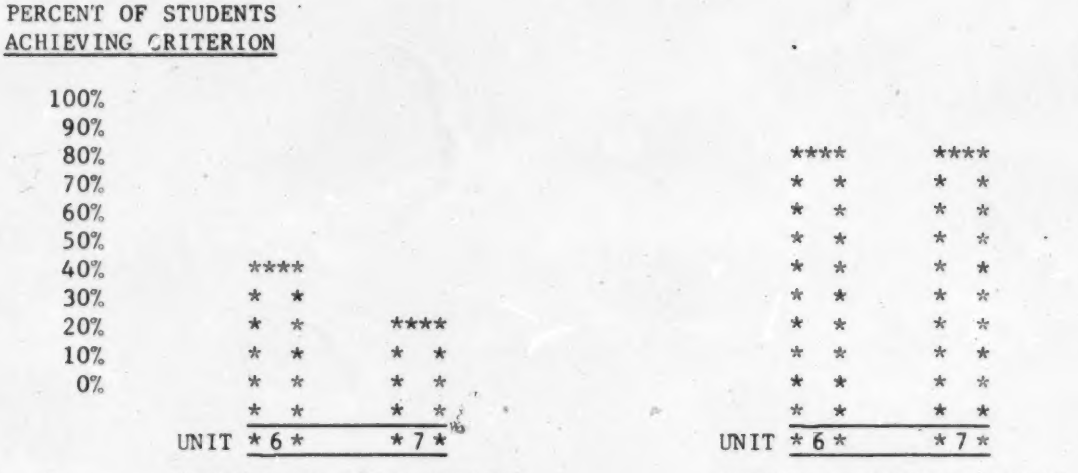
Display 4(A). Bar Graph showing the percentage of pupils within a class reaching criterion (80% correct on an outcome) on cummulative Criterion Exercises. (Reported in sets of five.)

REPORT #4(A)

PROGRAM: SYCSP
UNITS: 6-7
DISTRICT: LOS ANGELES (A)
SCHOOL: FIRST STREET
TEACHER: HANKS
MAY 15, 1971
CLASS: 1
PAGE 2





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Display 4(B). Numeric data indicating the percentage of pupils within a class reaching criterion (80% correct on an outcome) on cumulative Criterion Exercises.

REPORT #4(B)

PROGRAM: FYCSP
UNITS: 1-7
DISTRICT: L.A. (A)
SCHOOL: FIRST ST.
TEACHER: HANKS
MAY 31, 1971
CLASS: 2

OUTCOME	UNIT 1	2	3	4	5	6	7	8	9	10
I (WORDS)										
NO. OF STUDENTS	18	20	16		16	16	16			
% OF CLASS	90%	100%	80%		80%	80%	80%			
II (WORD ELEMENTS)										
NO. OF STUDENTS	20	16	12		4	4	4			
% OF CLASS	100%	80%	60%		20%	20%	20%			
III (WORD ATTACK)										
NO. OF STUDENTS	12	4	4		8	2	20			
% OF CLASS	60%	20%	20%		40%	10%	100%			
IV (LETTER NAMES)										
NO. OF STUDENTS	12	12	8		4	20	16			
% OF CLASS	60%	60%	40%		20%	100%	80%			

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Display 4(C). Statements describing the percentage of pupils within a class achieving mastery (80% correct on an outcome) on cummulative Criterion Exercises.

REPORT #4(C)

PROGRAM: FYCSP | DISTRICT: L.A. (A) | MAY 31, 1971
UNITS: 1-7 | SCHOOL: FIRST ST. | CLASS: 4
TEACHER: HANKS

This report presents the number and percent of students within this class reaching criterion on the IMS Criterion Exercises given to date.

Performance of this class on Outcome I (Words)

16 students or 80% of the class reached criterion on Unit 1
4 students or 20% of the class reached criterion on Unit 2
16 students or 80% of the class reached criterion on Unit 3
NO TEST
16 students or 80% of the class reached criterion on Unit 5
12 students or 60% of the class reached criterion on Unit 6
16 students or 80% of the class reached criterion on Unit 7

Performance of this class on Outcome II (Word Elements)

20 students or 100% of the class reached criterion on Unit 1
16 students or 80% of the class reached criterion on Unit 2
12 students or 60% of the class reached criterion on Unit 3
NO TEST
20 students or 100% of the class reached criterion on Unit 5
4 students or 20% of the class reached criterion on Unit 6
4 students or 20% of the class reached criterion on Unit 7

Performance of this class on Outcome III (Word Attack)

20 students or 100% of the class reached criterion on Unit 1
4 students or 20% of the class reached criterion on Unit 2
12 students or 60% of the class reached criterion on Unit 3
NO TEST
8 students or 40% of the class reached criterion on Unit 5
20 students or 100% of the class reached criterion on Unit 6
16 students or 80% of the class reached criterion on Unit 7

Performance of this class on Outcome IV (Letter Names)

12 students or 60% of the class reached criterion on Unit 1
12 students or 60% of the class reached criterion on Unit 2
8 students or 40% of the class reached criterion on Unit 3
NO TEST
20 students or 100% of the class reached criterion on Unit 5
16 students or 80% of the class reached criterion on Unit 6
16 students or 80% of the class reached criterion on Unit 7

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ATTACHMENT 3

With reference to Report #4, what factors do you like and what factors do you dislike about each Format, A, B, and C?

A. like -

dislike -

B. like -

dislike -

C. like -

dislike -

Which Format do you prefer overall?

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ATTACHMENT 4

Frequency of Comments Recorded on Questionnaire

FORMAT	NUMBER OF RESPONSES	POSITIVE COMMENTS	NUMBER OF RESPONSES	NEGATIVE COMMENTS
A	2	Quick comparisons are easy	16	2 pages are awkward, slow, or clumsy
	2	Allows for easy comparison of outcome performance across units	13	Difficult to locate percentages
	1	Included "NO TEST" statement	7	Doesn't include number of students
	1	Easy to locate area containing information	3	Asterisks are usually unpleasing
	1	Increases or decreases in performance are clearly seen	1	Labels don't stand out
	1	Prefers graphs	1	Difficult to compare units
B	14	Compact, simple, easy to read	1	Too much reading
	9	Easy comparisons	1	Needs a "NO TEST" statement
	7	All information present		
	1	All information is on one page		
	1	It is psychologically appealing		
C	1	It is written clearly	8	Too wordy
	1	It is good for comparison	8	It is bad
	1	Contains all information	4	Difficult to locate information
			1	Slows comparisons
			1	Form is crowded
			1	It provides no overview

ATTACHMENT 5

SWRL

DATE: June 23, 1971

TO: Dr. John F. McManus

FROM: Howard Wolfe

SUBJECT: COMPUTER COSTS ASSOCIATED WITH THE PROPOSED FORMATS FOR THE CLASS PERFORMANCE REPORTS

COPIES TO: J. Hooper, B. Roffman

The Class Performance Report consists of the percentage of the class reaching criterion on each outcome for a past range of units.

The proposed formats are:

A) Vertical bar graphs for each unit and outcome
B) Matrix (unit vs. outcome)
C) Descriptive sentences for each outcome and unit

See Attachment 2 for a sample of each format. Note that formats B and C include the N's as well as the percentages.

For each report the number of computer lines printed and the average length of each line can be used to estimate printing charges and transmission times.

These figures for a 10 unit SWRL program are supplied in Table 1 (number of print lines/report) and Table 2 (length of print lines in characters).

Printing Charges

Table 1 shows that format B involves the least number of print lines per report. Thus this format would be the most economical on a system with a flat charge for each page printed.

Transmission Times

For remote sites using a TTY as a receiving device the time to receive each report is determined by the number of characters in the report. The formula to calculate the number of characters per report is:

$T = A \times B + C \times D$ where

A = number of heading lines

B = length of each heading line

C = number of data lines

D = length of each data line

T = number of characters/report

The calculations for each format using the average figures over 10 units in Tables 1 and 2 are:

Format A

12 X 42 + 30 X 66 = 2484 characters

Format B

12 X 47 + 8 X 51 = 972 characters

Format C

15.6 X 60 + 22 X 64 = 2338 characters

This again shows B to be the most efficient.

CPU Time and Computer Memory

Format B is the most economical with respect to CPU time. Format A is the most costly. Computer memory is not significantly different for any of the formats.

HW:mp

TABLE 1

(No. of Print Lines)

UNIT NO.	RANGE OF UNITS REPORTED FOR FORMAT			FORMAT A			FORMAT B			FORMAT C		
	A	B	C	HEADINGS	DATA	TOTAL	HEADINGS	DATA	TOTAL	HEADINGS	DATA	TOTAL
1	1-1	1-1	1-1	12	30	42	12	8	20	12	4	16
2	1-2	1-2	1-2	12	30	42	12	8	20	12	8	20
3	1-3	1-3	1-3	12	30	42	12	8	20	12	12	24
4	1-4	1-4	1-4	12	30	42	12	8	20	12	16	28
5	1-5	1-5	1-5	12	30	42	12	8	20	12	20	32
6	6-6	1-6	1-6	12	30	42	12	8	20	12	24	36
7	6-7	1-7	1-7	12	30	42	12	8	20	12	28	40
8	6-8	1-8	1-8	12	30	42	12	8	20	24	32	56
9	6-9	1-9	1-9	12	30	42	12	8	20	24	36	60
10	6-10	1-10	1-10	12	30	42	12	8	20	24	40	64
Average				12	30	42	12	8	20	15.6	22	37.6

TABLE 2

(Length of Print Lines in Characters)

UNIT NO.	RANGE OF UNITS REPORTED FOR FORMAT			FORMAT A		FORMAT B		FORMAT C	
	A	B	C	HEADINGS (average)	DATA (maximum possible)	HEADINGS (average)	DATA (maximum possible)	HEADINGS (average)	DATA
1	1-1	1-1	1-1	42	54	47	24	60	64
2	1-2	1-2	1-2	42	60	47	30	60	64
3	1-3	1-3	1-3	42	66	47	36	60	64
4	1-4	1-4	1-4	42	72	47	42	60	64
5	1-5	1-5	1-5	42	78	47	48	60	64
6	6-6	1-6	1-6	42	54	47	54	60	64
7	6-7	1-7	1-7	42	60	47	60	60	64
8	6-8	1-8	1-8	42	66	47	66	60	64
9	6-9	1-9	1-9	42	72	47	72	60	64
10	6-10	1-10	1-10	42	78	47	78	60	64
Average									